

REMARKS

This Amendment is respectfully submitted to place rejected claims of subject Application in condition for allowance. Claims 1, 11 and 12 have been amended more clearly point out
5 the patentable subject matter of Applicants novel invention.

Claim 1, step (b), has been amended to recite: --Separating a portion of the oxidized sulfur and nitrogen-containing compounds from the oxidation zone effluent as by distillation to a cut point temperature by which 90 percent of the sulfur-
10 containing compounds in the feedstock would boil thereby rejecting a portion of the oxidized sulfur compounds as residue, and recover a distillate effluent having a reduced amount of the oxidized sulfur and nitrogen-containing compounds and a TAN number of less than about 2.0 mg
15 KOH/g-- Support for this amendment is found in the specification as filed, for example at page 17, lines 23 to 28 and at page 21, lines 6 to 9.

Dependent Claims 11 and 12 have been amended to depend from Claim 1 and refer to the term --distillation cut
20 point--.

Claim Rejections under 35 U.S.C. § 103(a)

In outstanding Office Action, Claims 1, 2, and 9 to 14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over (US 2002/0144932A1) US Patent 6,827,845 in the name of
25 William H. Gong, Monica Cristina Regalbuto and George A Huff, Jr. (Gong et al.) in view of US Patent 5,286,372 in the name of Blaise J. Arena, Jennifer S. Holmgren and Barret A. Ferm (Arene et al.). Applicants respectfully traverse these rejections.

The commonly assigned Gong et al. reference of record describes processes for oxidation of high-boiling, sulfur-rich fraction of a hydrotreated petroleum distillate using an immiscible liquid phase comprising at least one organic peracid or precursors of organic peracid in a liquid phase reaction mixture maintained substantially free of catalytic active metals and/or active metal-containing compounds and under conditions suitable for oxidation of one or more of the sulfur-containing and/or nitrogen-containing organic compounds (emphasis supplied). The oxidized sulfur-containing and oxidized nitrogen-containing compounds transfer from the liquid organic phase into the immiscible liquid thereby facilitating recovery of a high-boiling hydrotreated distillate fraction having a reduced content of sulfur-containing and oxidized nitrogen-containing compounds.

Contrary to the position of Examiner, the commonly assigned Gong et al. reference of record does not disclose or suggest fractionating the organic phase separated from the oxidation reaction mixture to remove therefrom oxidized sulfur-containing and/or oxidized nitrogen-containing organic compounds. According to Gong et al., they are in the immiscible liquid phase, not the organic phase.

In one aspect of the Gong et al. process, the low-boiling, sulfur-lean fraction of a hydrotreated petroleum distillate is directed to an optional oxygenation process unit. Because the sulfur-containing organic compounds have been separated from the hydrotreated petroleum distillate by the fractionation step, the optional oxygenation process unit is clearly not for the removal of sulfur.

As stated in Gong et al., the low-boiling, sulfur-lean fraction of the catalytic hydrotreated petroleum distillate is a valuable product in itself. However, the unit for oxygenation of

the sulfur-lean fraction is beneficial, because increasing the content of oxygen-containing organic compounds in refinery transportation fuel is known to decrease the content of particulate emissions in exhaust from internal combustion engines.

It should be apparent that having the immiscible liquid phase in the oxidation reaction mixture is a critical element of the Gong et al. process. More particularly, an immiscible liquid phase comprising at least one organic peracid or precursors of organic peracid in a liquid phase reaction mixture maintained substantially free of catalytic active metals and/or active metal-containing compounds.

By contrast, Applicants' novel process for reducing the sulfur and nitrogen content of a distillate feedstock to produce refinery transportation fuel or blending components for refinery transportation fuel wherein the feedstock contains heteroaromatic sulfur-containing and nitrogen-containing organic impurities includes --Separating a portion of the oxidized sulfur and nitrogen-containing compounds from the oxidation zone effluent as by distillation to a cut point temperature by which 90 percent of the sulfur-containing compounds in the feedstock would boil thereby rejecting a portion of the oxidized sulfur compounds as residue, and recover a distillate effluent having a reduced amount of the oxidized sulfur and nitrogen-containing compounds and a TAN number of less than about 2.0 mg KOH/g--.

It is the position of Applicants that replacement, in the Gong et al process, of the immiscible liquid phase in the oxidation reaction with any solid oxidation catalyst system is contrary to understanding the essential liquid to liquid transfer of the oxidized sulfur-containing and/or oxidized nitrogen-

containing organic compounds from the liquid organic phase into the immiscible liquid phase.

In contradistinction, Applicants' novel process recites contacting distillate and solid oxidation catalyst. In particular, an oxidation catalyst comprising at least one active Group VIII metal present in an amount ranging from about 4 percent to about 50 percent based on the total catalyst weight selected from the group consisting of the *d*-transition elements in the Periodic Table having atomic number from 21 to 30 inclusive, and a basic support selected from the group consisting of alkali oxides and alkaline earth oxides. No immiscible liquid phase is used in the oxidation reaction mixture.

In a further distinction, Applicants' novel process recites step (b) --Separating a portion of the oxidized sulfur and nitrogen-containing compounds from the oxidation zone effluent as by distillation--, not a step of liquid to liquid transport.

The Arena et al. reference of record describes a process for treating a hydrocarbon fraction which contains mercaptans by using a novel catalyst which is composed of a metal chelate dispersed on a solid support. The mercaptan containing hydrocarbon fraction is contacted with the metal chelate in the presence of an oxidizing agent and a polar compound, e.g., water and alcohols. The solid support on which the metal chelate is dispersed are either a solid solution of metal oxides or layered double hydroxides such as clay. Arena et al. state their process can use "any of the various metal chelates known to the art are as effective in catalyzing the oxidation of mercaptans contained in a sour petroleum distillate to disulfides" (Arena et al. Col. 3, lines 21 to 25).

Because the various metal chelates cited by Arena et al. are all described as requiring a solid support, none are suitable

for use in the processes described in Gong et al. for oxidation of a feedstock that contains heteroaromatic sulfur-containing and nitrogen-containing organic impurities.

Arena et al. cites a large number of known metal chelates, and states metal phthalocyanines are a preferred class of metal chelates, and it is important "that the metal chelate is impregnated on to the LDH and not intercalated. Impregnation results in a more active catalyst since intercalation stuffs the layer with the metal chelate thereby making it difficult for mercaptan molecules to get to the metal center" (Arena et al. Col. 5, lines 23 to 28). In particular, Example 2 describes preparation of cobalt phthalocyanine on a solid solution extrudate. The impregnated solid extrudate had an X-ray diffraction pattern characteristic of cobalt phthalocyanine on a solid. (Arena et al. Col. 8, lines 40 to 57).

It should be noted that the catalytic process described in the Arena et al. reference of record is only reported to be useful for the oxidation of mercaptans to disulfides, i.e. a sweetening process that does not convert heteroaromatic sulfur-containing compounds. According to Examples 3 and 4, the Arena et al. sweetening process is able to sweeten a sour kerosine feed and a sour hydrocarbon fraction. While the cobalt phthalocyanine on solid support demonstrated a short active life, the product mercaptan sulfur ranged upward from 11 ppm. (Arena et al. Col. 9, lines 21 to 24 and 46 to 48, TABLE 2 and TABLE 3).

It is important to understand that mercaptans are a group of organosulfur compounds that are derivative of hydrogen sulfide in the same way that alcohols are derivatives of water, and are found with other sulfur compounds, such as heteroaromatic sulfur-containing species, in crude petroleum: an example is methyl mercaptan (also now as thiol.) As is well known, mercaptans are typically removed by hydrotreating

petroleum distillate components for refinery transportation fuel. Reduction of heteroaromatic sulfur-containing compounds would require that the distillate be subjected to very severe catalytic hydrogenation in order to convert these compounds
5 into hydrocarbons and hydrogen sulfide.

Applicants process, for example as illustrated in Example 1 Table II in the specification as filed at page 21, achieves a shift in sulfur species to a heavier sulfur species which results in a desulfurization of about 90 percent and thereby achieving
10 sulfur levels, after subsequent separation step, to below about 5 ppm.

It is the position of Applicants that the Gong et al. alone or combination with Arene et al. references of record do not suggest the essence of their novel multi-step process as recited
15 according to instant Claims 1, 2 and 9 to 14.

With respect of claims 2, 9 and 14, Examiner avers that "Arena discloses using cobalt on magnesium oxide/ aluminum oxide support (See column 3, lines 4 - 6)." However, as discussed herein above Arena et al. in fact states "A specific
20 embodiment of the invention is a catalyst containing cobalt **phthalocyanine** on a magnesium oxide/ aluminum oxide support. This catalyst is used in conjunction with air and methanol to sweeten a sour hydrocarbon fraction (See column 3, lines 4 to 8)." That is to convert mercaptans to disulfides, which
25 is in contradistinction to oxidation of heteroaromatic sulfur-containing and nitrogen-containing organic impurities according to Applicants novel process.

Base on the amendments submitted herein, Applicants urge that Claims 1, 2, and 9 to 14, inclusive, all claims now
30 presented, are in condition for allowance. Applicants

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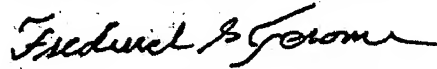
respectfully request Examiner Singh to pass subject application
for allowance.

Do not hesitate to contact Frederick S. Jerome whose
telephone number is (630) 832-7974 (FAX (630) 832-7976) if
5 additional assistance is needed regarding this paper or earlier
papers for Applicants.

Applicants and their undersigned Attorney appreciate
Examiner's attention and further consideration of this matter.

Respectfully submitted,

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